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REINFORCEMENT GENERALIZATION AS INTERACTION BETWEEN PROCESSES RATHER THAN EVENTS: ABSENCE OF SCHEDULE-INDUCED HYPERDIPSIA IN RATS WITH HISTORIES OF MINIMAL FOOD-WATER CONTIGUITY [1, 2]

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Summary.—All scientific disciplines contain concepts that reflect interactions between their processes as well as between their units. The divergence process (generalization) applied to reinforcement predicts the existence of reinforcement generalization. Existence of this operation was suggested by the absence of schedule-induced hyperdipsia in rats for which the normal temporal contiguity between eating and drinking had been prevented. The results indicate that through generalization of reinforcement, which could explain the adjunctive class of behaviors, reinforcement of one process evokes comparable changes in other processes even if their overt correlates are not displayed contiguously.

All sciences have concepts that refer to units or events. Aggregates of units or events (patterns) exhibit the properties of a field that reveal Gestalt principles. Units and aggregates are the spatial dimensions of conceptual understanding. All sciences also contain concepts that refer to processes. They (1) describe relationships between units or aggregates, (2) require time to be perceived as phenomena, and (3) are ultimately applied to aggregates which are themselves processes. The latter would be analogous to the topological tensor and would share similarities to mathematical derivatives.

The two major dichotomous units or events in learning theory are the stimulus and the response. Aggregates, such as behaviors, are composed of units of stimuli and responses that display the properties of a field or Gestalt. The central operation that associates the units of learning (stimuli and responses) is some variant of the concept of reinforcement.

Concept analysis (Persinger, unpublished) predicts that divergence should also occur within the reinforcement process. Interactions between aggregates are a function of the similarity of the units along dimensions that determine their coherence; in learning theory, these interactions are called stimulus generalization and response generalization. The amount of similarity is defined by the spatial gradient and reflects the consequences of the process of convergence. There should also be an interaction between processes

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that would be a function of the relative similarity between the subcomponents. If this concept is valid within learning theory, it could be manifested as *generalization of reinforcement*. It states that, if one stimulus-response aggregate is reinforced, then other aggregates of different stimuli and responses which are temporally contiguous will also be strengthened even though they were *not* overtly displayed or reinforced directly.

The two major processes that share the greatest temporal contiguity are eating and drinking. As shown by the original experiments of Verplanck and Hayes (1953), these two behaviors are mutually dependent. Reinforcement generalization suggests that this marked concordance is a function of the frequent temporal proximity of eating and drinking during the history of the animal.

Reinforcement generalization could explain adjunct conditioning which is considered neither operant nor respondent learning. For example, although rats exposed to an intermittent food-reinforcement schedule will respond appropriately to receive food pellets, they will also consume inordinate amounts of water (conditioned hyperdipsia) within the test setting even though they have not been water-deprived. This unusual phenomenon cannot be explained totally by usual subtypes of conditioning, e.g., superstitious association (Wetherington, 1982).

If the concept of reinforcement generalization is valid, then the hyperdipsia during food-rewarded tasks would be an artifact of the rats' reinforcement history because the consumption of food and water is normally temporally and spatially contiguous. Thus, when responses associated with food consumption are reinforced, the other responses (e.g., licking, water ingestion) associated with food consumption would be strengthened through reinforcement generalization. Consequently, an enhanced temporal density of one of these responses (eating) by an external contingency should evoke a comparable escalation of drinking (e.g., "hyperdipsia") if this option is available.

To test this hypothesis a total of 15 male Wistar rats from three litters were selected as subjects. Following weaning (Day 21) the rats were housed three per cage. Food and water were delivered for one hour, four times per day. However, for nine of the rats (three cages) the delivery of the food and water was displaced by one hour such that their food and water could never have been consumed either simultaneously or sequentially. The other six rats (two cages) served as controls; food and water were always presented together. To minimize the risk of attrition, fresh lettuce leaves were available in the cages of both groups during the first two weeks.

When the rats were 70 days of age, they were trained to respond to a VI-2 min. schedule within a standard (single-lever) operant chamber. On the wall opposite the lever, a 100-ml (1-ml gradations) water bottle was available.

The amount of water consumed during each 30-min. session as well as the response rate were measured daily for the 20 consecutive sessions. The results are shown in Fig. 1. Whereas none of the treated rats displayed hyperdipsia during the sessions, five of the six control rats displayed the expected response.

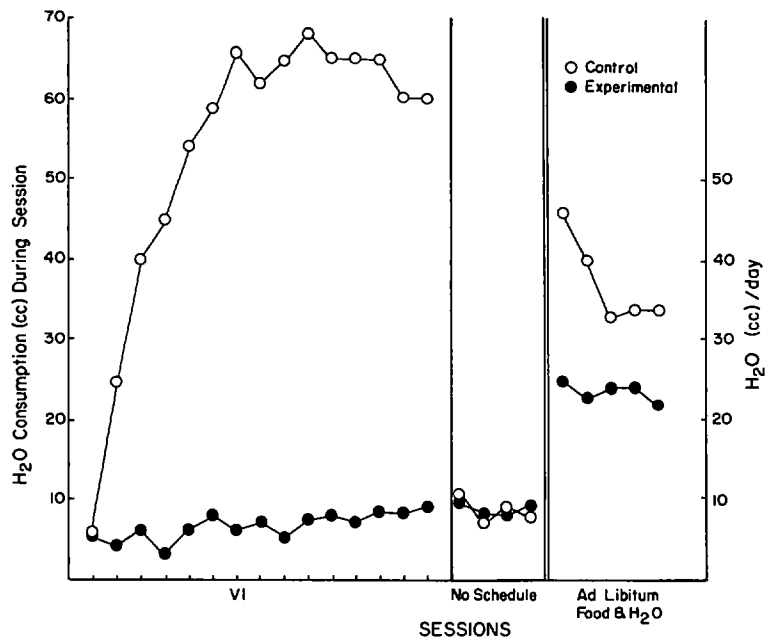

FIG. 1. Mean water consumption per session for normal rats and rats with histories of minimal temporal contiguity between fluid and food consumption. (*SD*s per day between 5 and 7 cc)

These results support the hypothesis that similarities in the characteristics of reinforcements facilitate generalization. In this instance, because responses associated with food consumption and water consumption had shared similar reinforcement (consumptive) processes and temporal contiguity in the animals' history, reward for one set of responses (eating) generalized to water-consumptive responses that resulted in the hyperdipsia. This association was not observed for any of the rats whose experimental history prevented the spatial and temporal contiguity between food and water. Interestingly, the rats in the experimental group either orally manipulated or ate the corncob bedding below the floor bars during the interreward intervals; this was never observed in the normal (control) rats. These behaviors suggest that for the experimental rats reinforcement had generalized to mandibular (mas-

ticatory) and manipulative movements (in absence of normal water-food interaction). Presumably they would have been the most powerful (or reinforced) behaviors during eating.

If this concept is applicable to human behavior, then any response whose reinforcement *process* is associated with the reinforcement *process* of another response should be strengthened. In the cognitive domain, the misattribution of an induced image or fantasy as a memory might be associated with the inclusions of ideas, fantasies, or extrapolations that are related to this induced image; these fantasies and extrapolations would become "memories." Discourse planning during cognition is considered to rely upon a tree geometry whereby topical propositions occupy specific nodal positions within the arbour; the nodes are functionally connected by linguistic or perceptual categories (Persinger & Makarec, 1991-1992).

If reinforcement generalization exists, then tensor relationships could facilitate reinforcement along the *affective* dimensions of cognition because temporal contiguity is powerful between the denotative (cognitive) and connotative (affective) dimensions (e.g., active-passive, unpleasant-pleasant; Whissell, Povey, & Dewson, 1987) of linguistic sequences. As a result the correlative cognitions and memories, typically unrelated or compartmentalized within the semantic lexicon, would be strengthened. The simple execution of one set of cognitions or responses would reinforce and encourage the display of cognitively unrelated but affectively associated cognitions or memories.

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